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THE LIFE AND WORKS OF BROWN-SÉQUARD.¹

By M. BERTHELOT.

Geber, the Arabian philosopher and chemist, asserts that the perfection of a being depends upon an exact equilibrium among its elements. Whenever that state of equilibrium is obtained, he says, the being becomes immortal, because there is then a complete compensation between its opposing elements and nature. Whatever may be thought of such reasoning, ideas and definitions of this kind correspond but little with the conditions that affect genius in art and science. In fact power and beauty generally are the result of the exaltation of certain qualities developed with an unusual intensity; this constitutes the true originality of genius, and all compensation between contrary aptitudes results in a certain mediocrity.

These truths have rarely found a more striking application than in the career of Brown-Séquard. He possessed qualities of imagination and of originality characteristic of great discoverers, rather than those habits of precision, accuracy, and application that belong to scientists of repute in their work, scientists that are perhaps more esteemed in the academies because they have fewer imperfections. Still, let us not forget that it is the inventive minds that keep humanity going.

Brown-Séquard was an inventor, and some of his fundamental ideas, thought to be strange and almost senseless at the time they were expressed, in the crude state in which he frequently left them, have yet shown an originality as marked, perhaps, as those of Pasteur or of Claude Bernard. Brown-Séquard left a profound mark on the biological field because he had a very high ideal of science, an ideal that he pursued in spite of all obstacles with a passionate devotion, sacrificing to it the idols ordinarily worshiped by man—money, position, and honors. In his business affairs there was the same instability, the same want of balance as in his intellectual career, and he passed an existence as wandering and agitated as that of a scientist of the sixteenth century. He spent his life between two races, the French and the Anglo Saxon, to both of which he belonged by family connections, traversing the routes of the

¹A paper read at the annual public session of the Académie des Sciences, of Paris, December 19, 1898. Translated from the *Revue Scientifique*, fourth series, Vol. X, pp. 801-812.

world, from the Indian Ocean, where he was born, to the coasts of Europe and America; sometimes an experimenter, sometimes a consulting physician, sometimes a scientific journalist, and sometimes a professor; at Paris, at London, at Dublin, at New York, at Boston, until the time when he found in his later years a resting place and the crown of his career in our old but always youthful College of France, always an asylum for original intellects, and in our Academy of Sciences, a final consecration of scientific work.

Such is the man whose life and work I am about to try to sketch.

Charles Édouard Brown-Séquard was born April 8, 1817, at Port-Louis (Mauritius) of an American father, Brown, of Philadelphia, and a French mother, who was a Mlle. Séquard, of Provençal origin. His father, a captain in the merchant marine, went to sea with his vessel some months before the birth of his son, and was never heard of again. Brown's lot was in this respect like that of E. Rénan, who also lost his father under similar circumstances. Our scientist bore, in his physical frame as in his intellectual character, the traces of this double origin, modified by the climate of his birthplace. From his mother he inherited that southern vivacity and sympathetic character that attracted so many to him, while from his father he derived that adventurous boldness which he carried into his experiments, and also that ability to promptly change the surroundings of his life and to work without cessation during the constant shifting about of an adventurous career. The tropical land where he was born endowed him with the physical characteristics of the Indian creole. Formerly a French colony, it was torn away from its native country by the disasters of 1814, because it was a naval station of the first rank, being the base of the bold expeditions conducted by Dupleix and La Bourdonnais, in the eighteenth century.

Therefore, England, who hastens to seize every island, every cape, and every strait that controls the sea, did not neglect to possess herself of Mauritius at the time of our misfortune. The population has, however, even to the present day, preserved a certain attachment for the country from which it sprang.

When Brown-Séquard was born Mauritius was no longer French territory, and this was the reason why, when after a wandering existence, he wished at the decline of his life to settle finally in France, it was necessary for him to become naturalized. Still his native tongue was French, and when he made his first visit to the United States he was obliged to learn English, which he did during the voyage.

In the midst of privation and poverty his mother raised him with a tenderness of which he always preserved the most lively remembrance. She lived by the work of her needle, employing an aged negro to sell her embroidery. Thus it was that our future colleague was initiated into the severe struggle for existence, an initiation that tempers the spirit of those that can submit to it without shrinking. It is well to

detail it here in order that we may understand the course which Brown pursued for a long time and the incomplete character of his works.

At 15 years of age he became a clerk in a colonial provision store, which was also, as in Italy, a place of rendezvous and gossip, so that the young man was in contact not only with the laboring people but also with the cultivated residents of the neighborhood. He showed the influence of the latter by writing poetry, romances, and plays, a beginning often made by those who have not received a regular education. In reality these attempts are about equivalent to the scholastic exercises produced by the rhetoricians and philosophers of our graduating classes.

At 20 years of age Brown set out with his mother for Paris, then the ideal center of attraction for natives of Mauritius. Immediately on his arrival in 1838, counting innocently on his literary talents for support, he presented his works to Charles Nodier, who hastened to enlighten him as to their true merit by saying, "In order to live you must take up some regular business, my friend."

Claude Bernard had in a similar manner begun by writing a tragedy. But without being rich he was not so poor as Brown-Séquard. The latter, also like Bernard, followed the advice given him and decided that he would become a physician, a profession for which he had hitherto shown no predilection.

This profession did but little toward satisfying his immediate wants, for it could bring in nothing until after long years of apprenticeship. Besides, Brown-Séquard had no preparation for it whatever; preliminary scientific knowledge was wanting as well as material resources. Special qualifications were also needed, but of these there was fortunately no lack.

The mother and son leased rooms in the rue Férou near St. Sulpice, and there gave board and lodging to students from Mauritius who were more fortunate than they.

These little groups of foreigners, clustering around their compatriots, are common in Paris; it is greatly to be regretted that the administration has of late years made constant efforts to discourage them and to get them attached to faculties in the provinces, where they will not acquire so readily a hearty sympathy with our national life.

In the meantime Brown-Séquard was at work trying to amend, or rather to completely renew, his education. He prepared at the same time his medical examinations and two baccalaureate courses in letters and sciences; for it had not yet pleased the authorities to prolong the duration of the courses which are now retarded by a series of barriers regularly spaced off.

Our future colleague filled a double office, that of pupil in the laboratory of Martin Magron and that of tutor, transmitting the knowledge that he had just acquired to his less active and less intelligent comrades. This is a profession in which more than one of us has commenced his career, thus finding, as did Brown-Séquard, the pecuniary

resources necessary for obtaining an education. It should not be supposed that these conditions are absolutely unfavorable; on the contrary, by teaching one is forced to learn more thoroughly what is taught; some author, whose name I do not remember, has said that in order to teach it is necessary to know a subject twice over. A teacher must certainly apply himself to think out and assimilate his subject in a way not often accomplished by the young student who pays scanty attention to the lesson, listening with a distracted mind and perhaps never thinking of it again.

It was by contact with these Parisian masters that there came to Brown-Séquard the revelation of his true vocation, which had hitherto remained obscure. While reproducing the experiments of others in the laboratory of Martin Magron, he conceived the idea of experimenting on his own account; his passion for physiology burst forth and assisted to sustain him in the midst of painful trials while he was entering upon a life of difficulties. He was, in fact, soon subjected to both personal and family troubles.

A dissecting wound, an accident still too frequent among students, made him ill for long months. Scarcely had he recovered when he lost his mother, his devoted companion and support. Brown-Séquard had a peculiarly sensitive and affectionate nature, which often made him unhappy during the course of his life. Prostrated by this unexpected stroke, carried away by an irresistible influence, and semidelirious, he quitted Paris and embarked for his native land. Hardly arrived there, more reduced in material resources than ever, and finding it impossible to renew them in so restricted a sphere, he obtained the aid of a friend to return to Paris.

Friends were never wanting to Brown-Séquard. Like all loving natures he always received keen and affectionate sympathy.

He then returned to Paris, poorer than ever, to finish his medical studies, working in a poor chamber and nourished sometimes on only dry bread and water; without fire in the dead of winter, living helter-skelter with guinea pigs and rabbits, the subjects of his experiments, who were henceforth to be his companions up to his very last moments, for half a century.

He graduated in medicine in 1840, publishing in his thesis a preliminary sketch of his researches on the nervous system.

It should not, however, be supposed that Brown was always unhappy; as is usual in youth he lived upon imagination and hope, exalted by his discoveries. He often in after life referred to these first years with affectionate remembrance.

This young man, so industrious and zealous, could not long fail to receive aid from those around him—aid from the young scientists and artists of his own age, aid also from scientists who had already become famous. If we should accuse some of the latter of being selfish and jealous it would be an accusation which, as all this company knows, it

would be very unjust to make general. Among the devotees of science there are many who are happy to aid and encourage beginners, to sustain them, and to hand to them in turn the torch of science, which it is our duty, our honor, and our pleasure to keep burning still more brilliantly during the next generation.

In this manner Brown-Séquard lived until about 1848. At this epoch, so fertile in disclosures and in quickly-blighted hopes, he found himself placed, because of his experimental work, in relation with the Society of Biology, founded during that very year, and of which he was later to become one of the principal pillars of support.

The Society of Biology had just been founded at the instance of certain young men, such as Charles Robin, Claude Bernard, Follin, and others whose names have become well known. Brown-Séquard was one of its first four secretaries. It was and has not ceased to be an excellent forum for the study and discussion of problems of natural science, a forum less solemn than those of the academies, the discussions being more friendly, not being exposed in the same degree to disturbing vanities and personalities unduly excited by a sometimes excessive publicity. There is found there a sincerity and consequently a greater certitude in the demonstrations as well as the concurrence and collaboration of comrades of the same age not yet disunited by the rivalries of a career.

On the other hand, resources of all kinds were scanty at the Society of Biology. Science, especially at that time, furnished but little to beginners. Since then the Republic has increased these resources, especially in the form of those scholarships for superior instruction, which have in recent times been unjustly attacked by those who have narrow views, and who are perhaps actuated by jealousy of progressive methods.

While the Society of Biology did not furnish the same resources as we have at our command to-day, it nevertheless aided, even from the first, the young scientists who crowded to its ranks, attracted both by the confraternity of scientific work and by the good will of the first president, Rayer. Rayer was a man of experience and judgment rather than of originality; a clever man who had by his merit attained a good position, both from a pecuniary and a scientific point of view. This did not prevent him from remembering that in his youth he had suffered from the religious and philosophical intolerance of the Restoration, which had barred him from a teaching career, and he took pleasure in protecting young scientists and in aiding them by his influence, which was great, and which was to become much greater by reason of the repute that attached to him because of professional medical services rendered to prominent and powerful people. Claude Bernard, Charles Robin, and others also, among whom I have the honor to count myself, have received from Rayer assistance in their careers which they have never forgotten.

Rayer thus gave to Brown-Séquard his first opportunities for work; he interested himself in him and confided to his care certain patients whom he thought ought to be treated by galvanism.

The next year, in 1849, during that deadly epidemic of cholera, which left a profound impression on the minds of the students and doctors of my time who were called to treat the sick and dying, Brown-Séquard was appointed as assistant physician at the military hospital of Gros-Caillou. It was a dangerous post, requiring devotion to duty. Brown never drew back on such occasions.

Still his means of existence continued to be uncertain. In 1852 he found himself at the end of his resources, and his republican opinions hardly permitted him to hope for any official support. He embarked for New York on a sailing vessel. He was ignorant of the language of the country where he was going to seek his fortune, but he smilingly said that he counted on the length of the voyage for learning English and on his profession for subsistence when he had once arrived in the United States. He showed at this time that mixture of almost childish want of foresight and self-confidence that characterized his entire life; tossed about incessantly from fortune to poverty, always rescued before reaching the last extremity and always recovering himself by his own energy.

Thus it was that he commenced that irregular career that led him so many times from France to England and to America, and from America to England and to France, attracted on the one hand by the desire for a life in Paris, the only place where his scientific instincts were completely satisfied, and on the other by his Anglo-American traditions that led him to seek for a living in New York or London, where applied science was more generously compensated. He crossed the ocean in this way more than sixty times in the course of a half century.

This existence of a scientist wandering from country to country becomes more and more rare and difficult. During the sixteenth century it was almost the usual method of life. As the new spirit of the Renaissance found but little encouragement in the old scholastic universities, scientists and artists were then in the habit of wandering between France, Italy, Germany, and sometimes England, seeking the protection, too often capricious, of princes and sovereigns. In the seventeenth century Louis XIV called to France Cassini, Huyghens, and many others, some of whom, indeed, founded dynasties there.

The eighteenth century, with its ideas concerning the moral and intellectual unity of the human race, was favorable to this wandering habit. Even in our own days we have seen that in the early part of the present century it was kept up between France, Italy, and Germany, as well as between Germany, England, and Russia. It would be easy to cite numerous examples of this, but since the wars of the last forty years that have established the great European States these powers have become more jealous of each other; each has tried to preserve

more and more the advantages of its own State for its own citizens. This tendency to exclusion has begun to affect even the United States. The life of a wandering scientist, such as Brown-Séquard, has therefore become quite difficult. Perhaps, indeed, it would not have been possible, even in his time, had he not possessed special qualities derived from his racial origin.

Although we can thus easily explain the national exclusiveness of the present day, we may perhaps in certain respects see cause to regret it; for the exchange of ideas and conceptions between peoples is more easily effected by means of persons than by books, and this exchange is indispensable for the general diffusion of knowledge and culture.

Hardly had Brown-Séquard landed at New York when he was obliged to give lessons in French to support himself. He made the acquaintance of some of the distinguished physicians of the city who had attended at Paris the lectures of Magendie, Andral, and Bouillaud. They obtained for him the post of teacher of experimental physiology in one of the American medical schools. At the present time a young Parisian physician would hardly find such resources in New York. In the first place, because scientific culture has remarkably developed in America during the past half century, and the Americans find among themselves the necessary teachers; but also because we no longer, to the great damage of French influence, give the same welcome to foreign students. Too frequently, repulsed by us, they go to complete their education in Germany. Let us hope that our University of Paris will pursue a more enlightened course and repair the sad mistakes into which narrow-minded persons have led her.

In 1853 Brown Séquard was in America and led there a very unsettled life. In order to support himself he resorted to obstetric practice at \$5 a case, and assisted in the preparation of a treatise on obstetrics. In the meantime he married, espousing Miss Fletcher, niece of Daniel Webster, the celebrated orator, and had by her a son, recently deceased, who gave his father but little satisfaction. Brown-Séquard returned to France during the summer, without, however, finding there any more solid means of support. Patients did not care for a physician so unsettled in his habits. He would not, however, abandon science, which was always the principal subject of his thoughts. It was, indeed, at this time that he published, in the *Philosophical Medical Examiner*, his first paper on experimental epilepsy. Still adventurous and unsettled, he returned to the United States, to leave again in 1854, in order to visit Mauritius, his native island. There he chanced upon an epidemic of cholera, which was decimating the population. Physicians were needed. Brown Séquard was put in charge of a hospital and various relief establishments. The treatment he adopted, founded upon the use of opium, was in accordance with the practice of the period. The principal fruit of his services was a gold medal, struck by order of the

municipality of Port Louis. At the end of the year he returned to the United States, where he received the appointment of professor of physiology in the University of Richmond, Virginia, and began his course in 1855.

He seemed then to have a secure position, which would enable him to live and to devote himself to original researches. This was, however, a delusion. The directors and the pupils of the university required didactic, elementary knowledge only, to prepare the pupils to answer examination questions. As to original researches, neither the one nor the other cared anything about them. Besides, there were already coming up in Virginia certain problems of a more extended political and social character, relating to slavery, an institution thought by the Southern States to be essential. Already there was beginning that fermentation which culminated a few years later in the war of secession. Now Brown-Séguard was too much attached to the humanitarian ideas of the eighteenth century and of the French revolution to hesitate. His social position in Richmond became unpleasant. It was practicable for him to make a change he had in view, as he had been able to acquire some income in the practice of medicine. Accordingly, instead of pursuing in the United States the career now open before him, he took advantage of the small sum he had accumulated by economy and hastened to Paris, the center of attraction to which he was always drawn.

It was at this period that I saw him for the first time, at the end of 1855, in the sympathetic circle of the Society of Biology. He was then 38 years of age. I have still before me a vision of that original face, delicate and kindly, embrowned by the climate of his native island; those keen and gentle eyes, always in restless motion, animated at once with an affectionate regard for the friends of science and by an unceasing and ever-watchful curiosity, which led him to search out her secrets, and also by some inexplicable feeling of timidity, which doubtless caused his inability to manage his own affairs.

His personal devotion to science was unbounded, and led him more than once to make experiments that might endanger his health. Thus he repeated in his own person the experiments that Spallanzani had made upon ravens, that of collecting gastric juice by means of a sponge attached to a string, swallowing the former and then withdrawing it from his stomach charged with the precious liquid. The following story, even more striking, is related of him.

In 1851 he was making researches upon red and dark blood. He injected into the arm of an executed criminal, thirteen hours after decapitation, 250 grams of his own blood, obtained by opening a vein.

In 1855 he set up in the rue St. Jacques a physiological laboratory in common with Charles Robin, another investigator who was also loved by the young. Among the beginners of that period who have since made their mark it will suffice to mention our friend Laboulbène, pro-

fessor in the faculty of medicine, who has recently been snatched from us; Rosenthal, of Vienna, Westphal, of Berlin, Czermak, and others whose names I no longer remember. The vivacity and personal force of Brown-Séquard, together with the simplicity, the innocent sincerity, and the generosity of his character were particularly attractive to young men; but he did not have the same influence upon men of age and authority, who during that period of social constraint, looked upon all innovations with a suspicion fortunately unknown to the present generation.

The method of Brown-Séquard also excited some distrust among those scientists who demand a didactic rigor for all demonstrations. He proceeded rather by intuitions, based upon the execution of incomplete experiments, which appeared still more unsatisfactory because of the extreme complexity of physiological problems. Hence arose many difficulties and doubts, which prevented for a long time the reputation of our future colleague from obtaining that extent and solid foundation which it has since acquired.

At this time he was engaged in researches upon the suprarenal capsules and particularly upon the spinal cord which contradicted the accepted views. These gave him a certain notoriety among neurologists. I will again refer to them later.

Nevertheless, in 1856, the Academy of Sciences awarded him a prize. The fees of the pupils in his laboratory provided him with some resources, and the assistance of Rayer gave him some patients. As his scientific reputation began to be reestablished, the nature of his work gave him authority as a practitioner in the domain of nervous diseases, that field so pregnant with doubts and with desperate hopes. His practice began to assure him the advantages of a professional career. It is well known that men esteem but little those scientific discoveries that can not be turned to profit.

The researches of our colleague upon epilepsy, its etiology and treatment, were especially celebrated. Always active, and always scattering his forces, he took up the most diverse projects. He went to London, Edinburgh, Glasgow, and Dublin to exhibit his discoveries. His authority was at this period greater, perhaps, in England than in France; he was therefore divided between the two countries.

In 1888 he undertook at Paris the publication of the *Journal de Physiologie de l'homme et des animaux*, filled with his own contributions during eight years.

In the month of May, in the same year, he was called to the Royal College of Surgeons of England, and delivered there six lectures in which he summarized his work on the nervous centers and gave his ideas as to the relations between the experimental researches and the therapeutics of the nervous system. These lectures were published in 1860 in Philadelphia; that is to say, in the third of the intellectual centers between which Brown-Séquard continually vibrated.

His experiments on epilepsy, its experimental production, and hereditary transmission, had especially struck the world of medicine and established the reputation of Brown as a neuro-pathologist. Therefore when there was founded in London a national hospital for epileptics and paralytics, Brown was appointed, in 1859, its physician, a position which he held for only a few years. It was there that he finally assumed the character of the chief of a school, and students hastened to attend his instruction. No salary was attached to this position of physician to the hospital, but there were compensations both in the way of honors and of money. In 1861 Brown was elected a member of the Royal Society of London. At the same time he became, in England, a consulting physician whose advice was very much sought, and was in the way to make his fortune. His reputation extended at the same time in France, in England, and the United States, everywhere assured because of his devotion, his activity, and his love for science.

He indeed preferred science for herself alone rather than for any profit that could be gained by her aid. His patients wearied him and his restless nature prevented him from remaining for a long time in the same place or in the same position. As he became more confident of the value of his discoveries, he became more firmly resolved to devote himself to a purely scientific career as soon as he could obtain the necessary means of existence. This confidence had its base in his complete and absolute respect for truth, in his slight regard for personal considerations, and especially in his lack of pretensions to infallibility, a too frequent weakness of some of the most celebrated geniuses.

In 1863 we find him again at Boston, professor of the pathology of the nervous system in Harvard University. It was his wife, a native of Boston, who had persuaded him to this change. His name and teaching had become popular in America. Happy, surrounded by friends, sustained by the influence of Agassiz, who was then all-powerful in the American universities, Brown-Séquard seemed to have at last become settled in his life and in his career. Alas! it was then, as often happens in our lives, that misfortune struck him a second blow in his dearest affections and disturbed his life and his thought—his wife died in 1867.

When he lost his mother, seized with a sort of irresistible impulse, he quitted all and fled from Paris to Mauritius, seeking in an irreflective physical agitation, if not consolation, at least distraction from the domestic grief which overwhelmed him. Twenty years after, the death of his wife, whom he had married in 1853, plunged him again into a similarly disturbed condition. He soon quitted the place where his grief had prostrated him, and in 1867 returned to France, resuming there the source of a career that had been interrupted for nine years. Thus his life again recommenced, like a series of equal periodic cycles, in which he continually repeated his triple part of experimenter, journalist, and professor.

As an experimenter he occupied himself with researches ceaselessly begun, laid aside, then taken up again and thoroughly carried out, upon the physiology and pathology of the nervous system.

As a journalist he continued his *Journal de Physiologie*, abandoned in 1864 for the *Archives de Physiologie*, published in collaboration with Charcot and Vulpian. Scientific journalism always had for him a particular attraction, in spite of the fatigues and disappointments of the profession. He loved to write according to his own fancy as well as to combine ingenious experiments. He stimulated his collaborators and showed them original work to be done, applauding every novelty, attentive to every mark of talent in young people. He worked much and made others about him work.

As professor he also made his way and became established, thanks to his personal popularity and to the influence of Agassiz and of Rayer, now more powerful than ever as physician to the Emperor, and likewise supported by letters from Agassiz, who had great influence with Napoleon III.

Rayer had made a breach in the long-established routine of the faculty and had undertaken a reform which failed for reasons it is unnecessary to recall here. He profited by his transitory authority to establish, for the benefit of Brown-Séguard, a provisional course of experimental physiology in the Faculty of Medicine of Paris. Nothing more could be done on the staff, as Brown was not a French citizen. He thus reappeared as a professor where he had been a student in his youth. Claude Bernard, Vulpian, and Brown had climbed up side by side, constantly increasing in reputation and discoveries, the ladder of superior instruction by which we are elevated, little by little, to the first rank, by force of merit and the opinion of our peers.

Brown-Séguard was not made for a didactic lecturer, nor was he likely to carry away his auditors by bursts of borrowed eloquence. But he excelled in displaying his own discoveries with a sincerity that was not wanting in finesse. His researches on the hereditary transmission of nervous lesions attracted the attention of both physicians and naturalists. They were also in close relation with the theories of Lamarck and Darwin on the gradual modification of organisms transformed both by natural selection and the artificial conditions of existence.

But Brown could not bring himself to continue a fixed residence anywhere. During the siege of Paris he was on a journey to the United States, where he gave a series of lectures of which the proceeds were intended for our wounded.

In 1872 there was another change. He married a second time, his bride being an American, Mrs. Carlyle, of Cincinnati, by whom he had a daughter, now the wife of a physician in Dublin. He gave up his provisional chair in Paris at the moment when measures had been taken to naturalize him, so that it could be made permanent, and estab-

lished himself at New York as a consulting physician. His marriages were always one of the causes of the perpetual oscillations which prevented him from taking root anywhere. He hastened, as was his invariable method, to immediately found a medical journal, *The Archives of Scientific and Practical Medicine and Surgery*. But few numbers of this journal were published. It contained Brown's first paper upon inhibition and dynamogeny.

This new period of his life was not a happy one. Disturbed by domestic troubles, finding nowhere about him the quiet necessary for his scientific pursuits, tormented by a perpetual need for money which he could not succeed in controlling, his tired faculties no longer sufficing for the simultaneous efforts required for the enforced quiet of scientific reflection and the struggle for material resources, Brown-Séguard now passed some of the most painful years of his life.

On February 12, 1873, in a private letter to a friend, he wrote: "You are young, and you have a numerous family; you have, as a compensation for your exile, the constant assurance of sincere affection. But I, who am growing old with frightful rapidity, have near me only people destitute of any tender feeling. Alas! what will become of me?" "Your departure," he again said, "is the greatest misfortune that has happened to me for a long time. Not only were you a consolation to me by your sincere attachment, you were also a living reminder of the Society of Biology and of my Parisian friends. I can not endure the idea of living here for the rest of my life. I am very unhappy. In the future I intend," he adds, not without a certain artlessness, "to pass four or five weeks in England, three or four months in Paris, and the winter here. I can make a living."

He succeeded in doing this by means of medical consultations. The publication of the journal had led to some losses of money; his lectures brought but little profit. But nervous disorders abounded; in this respect he seemed not to want for resources. "I arrived from Boston to-day (April 20). I have never seen anything like the scenes that occurred yesterday. From 7 o'clock in the morning to 8 o'clock in the evening, when I refused to see any more sick, there was an uninterrupted flow of very patient patients. The last which I saw had been waiting for their turn for five or six hours."

At this time, too, the scientific career of Brown-Séguard appeared to be settled by a definite appointment in America. I refer to a chair of physiology, provided with a vast laboratory and forming part of a great scientific establishment that Agassiz had organized with the aid of a generous patron. The matter should be reported in detail, as it is characteristic of the state of science in the United States.

"You know about Agassiz Island (on the north side of Long Island)," writes Brown to a friend. "It is about as large as the various public parks of London put together; it is very fertile, and is worth, together with the houses that have been built upon it, \$100,000. Mr. Anderson,

who gave this island to Agassiz, has just authorized him to expend upon it the whole of a capital of \$50,000. Agassiz has asked me the direct question: "What will you take per year to carry on the chair of experimental physiology that I propose to found? Include in this all your expenses, for I wish you to give up the practice of medicine." This was even beyond the dreams of Brown-Séquard, and to crown it he adds: "Agassiz is soon going to have thousands of rabbits, guinea pigs, birds, pigs, cats, dogs, and living cold-blooded animals, all of which he will put at the disposal of experimenters. Why am I not again 30 years old!"

But this ideal dream of the physiologist was not to be realized. Agassiz fell sick, and the propositions that he had made to Brown came to nothing. Institutions that depend on the good will of a single person are subject to the same vicissitudes as his life or his mental condition. Those only rest on a solid foundation that have the support of the State, or, at least, that of a great organization controlling unincumbered capital. We have been informed by several European scientists who have settled in America that the regular salaries are small when we take into account the increased cost of living, and the situations are not always permanent, as in old Europe. If donors are easily found to encourage a scientific project, continual support is more rare and often dependent upon the good will of someone, or upon the legislative assemblies, which regulate and change it every year.

In the month of July, 1873, Brown-Séquard was again in Europe, at Brighton, sick, exhausted both by work and by domestic troubles. "I am in the depths of despair; life is odious to me. It is possible that I will never return to America." In October, however, he was again in New York, always a prey to the most sinister foreboding. "I have a constant headache. I think that I am fatally affected." Annoyances of all kinds and money embarrassments increased; his patients did not pay him, and he adds: "They owe me nearly \$4,700; I would be bankrupt if an illness should keep me for a month without making anything." His impressionable nature was still more disturbed by his domestic troubles than by his pecuniary embarrassments. "Despair and uncertainty; these are my lot. What would I not give to have you with me. I have so much need of your sympathy and assistance. I can rely no longer on my own health. I fear that I may die suddenly, or fall sick, good for nothing—I am afraid I have a serious cerebral affection. If you have more confidence than I in my health, come to me as soon as possible. As soon as I have no longer any depressing influence near me everything becomes easy. My wife is always very sick; as for myself, I am exhausted." But his generous feelings awaken at the touch of science. "The fact is decisive," he answers a correspondent, who had written him concerning an observation, "it belongs to you; pull the string and you will then pass to another."

In 1874 he lost his second wife, whose conduct had been a source of

perpetual torment to him. But he was still disturbed concerning the career of his son. It was at this time that he refused a chair in the University of Glasgow, because of the climate. He repaired to New York, to Chester, to Paris, and in 1875 again returned to New York, always involved in financial difficulties. "I have the means for living just nine months, after which there is absolutely nothing. I must once for all put myself in a position to earn something for my old age, which is rapidly coming on."

The years 1874 and 1875 were thus passed in agitations of all kinds—illness, melancholy, and lamentations—without his being able to decide what to do. He hesitated between Glasgow, Geneva, Paris, and New York. "To choose is very perplexing; there are difficulties everywhere." In the midst of all this he gave lectures on amaurosis and hemianæsthesia; a scientific discussion with Charcot in the Society of Biology excited him greatly. Another trait of character may be mentioned: In 1876 he visited in Paris, as a consulting physician, Dom Pedro, whose affable and open countenance we all remember. Yet Brown-Séquard did not feel entirely satisfied. He saw that sovereigns do not like to be treated on terms of equality; one can always feel the claw under the velvet foot of the leopard.

In 1877 he married a third time, espousing the widow of Doherty, the painter. This wife died in 1894, a few months before him. It was at the time of this marriage that he accepted for a while a chair of physiology in the University of Geneva, but circumstances prevented him from ever occupying it. He had, however, reached the end of his life of wandering and agitation and was about to find among us, in a purely scientific situation of the very first rank, a rest for his declining years, surrounded by honors to which his long career entitled him. He had always been dominated by an ardent zeal for intellectual matters, and he had not hesitated to sacrifice to them the advantages, even though well earned, which belong to a purely professional career.

Brown-Séquard was in New York, in 1878, when he heard of the death of Claude Bernard, who was snatched away after a few weeks' illness by an affection of the kidneys. Brown immediately proceeded to Paris to apply for the position. No chair could suit better this original mind than that which had been occupied by Magendie and Claude Bernard, nor could any teaching be better adapted to him than that in the College of France, a teaching essentially personal and in which each teacher gives out his own ideas and exhibits his own work at the very moment he has completed it, whether in his study or in his laboratory, without any care for a didactic course, following no set programme, not subject to the fatigue of examinations which are at once the evidence of a course and the proof of capacity of candidates for diplomas. This way of considering teaching as a personal matter suited perfectly the vivacious mind of Brown-Séquard, characterized by good qualities and by imperfections, but, above all, original and inventive. He was,

therefore, warmly welcomed by the assembly of professors of the college and by the section of the academy, by whom he was presented to the minister. But he had first to go through the formalities of naturalization, which was indispensable to a titular professor.

So Brown-Séquard finally settled in France, and never again recrossed that ocean which he had traversed so many times. He found among us that regular support that was necessary for the carrying on of his work. He ceased to be distracted between the struggle for existence, which must be the care of every man, and the necessity for searching for the truth, which was his individual predilection. Hitherto he had oscillated between the two without being able to resolve to live with such singleness of purpose as would have freed him both from perplexities and weakness in his business affairs and in his scientific work. He henceforth, for sixteen years, lived happily and tranquilly, at least as much so as his ever-active nature would permit.

His activity did not, indeed, decrease.

As early as 1875, at the time when he was making his researches upon inhibition, he touched upon a new subject which he was destined to develop more as the time went on; this was the subject of internal secretions and their physiological significance. In 1881 the Academy awarded him the Lacaze prize; in 1885 the great biennial prize. In 1886 he was elected a member of the Academy of Sciences in the section of medicine. He succeeded Vulpian as he had succeeded Claude Bernard in the College of France. Both had been for a quarter of a century his colleagues in the Society of Biology. They had been presidents of that society. Brown-Séquard also became one in his turn, in the place of Paul Bert, who was younger, but who yet died before him.

He there trained pupils who have since made their mark, and he had for his successor our colleague, d'Arsonval, who served his apprenticeship at the College of France under Claude Bernard and Brown-Séquard, and who took, in his turn, a special flight of his own, giving to his teaching an originality no less striking. So it is that in life we are called to replace successively the friends of our youth and more mature age. We may be counted happy if, during the long course of our existence, our affections have not been chilled or blasted by rivalries, or even by divergencies, at first inappreciable, which gradually separate characters and interests.

In 1894 Brown-Séquard lost his third companion, to whom he had been tenderly attached for eighteen years. Although time had calmed the expression of his feelings, formerly so violent, still it had not chilled his heart. This last stroke was too much for him—he could not bear it. “I can work no more,” he said, “all is finished.” He returned from Nice to Paris in March, and expired on the 1st of April. At the International Congress at Rome, which was in session at that time, our colleague, Bouchard, with tears in his eyes, read to the section of physiology the dispatch announcing the death of the illustrious scientist.

The entire assembly rose, animated by feelings of respect and sorrow. It sent a telegram of condolence to the Academy of Sciences at Paris—a last homage to the life that was wholly devoted to disinterested research for truth.

The scientific work of Brown-Séquard is considerable in amount and extends to nearly all branches of physiology, these being traversed in turn by this indefatigable explorer.

This work bears the stamp of the personality of the author. It is of an intuitive character, governed by his imagination, quick to perceive the original side of new problems and to attack old problems in an unexpected way. But he did not stick long to any point; he was not one of those who study for a long time with minute attention a particular fact under all conditions until they have a complete knowledge of it. Constantly drawn in divers directions by an inexhaustible curiosity, he had no time to analyze in an extended and rigorous manner the facts he had just discovered. He was in too much of a hurry to get on and had to return to his work again and again and repeat his imperfectly finished studies and demonstrations, for, though he often changed the object of his researches, they were always present in his mind, and he was always seeking to carry them further, never hesitating to acknowledge former errors. This is a phenomenon that has often been noted in the history of science; there is a certain opposition, or, rather, contrast, often seen between the inventive genius who discovers new facts and the precise mind that gives to them the final sanction of exact demonstration. These two kinds of minds are equally necessary and supplement each other reciprocally, without there being, however, any exact line of demarcation between the scientists who possess them. Thus Brown-Séquard, who may be said to be an inventor rather than a demonstrator, once gave at London a lecture (called the Croonian lecture) on the life of the muscles, a lecture cited by John Stuart Mills in his *Treatise on Logic* as a perfect example of the employment of the four scientific methods.

The labors of Brown-Séquard were directed especially and principally to the elucidation of the necessarily related subjects, the physiology and pathology of the nervous system. During the latter years of his life he added to it a new investigation, equally important, which has opened surprising vistas in medicine—that of internal secretions and their normal office in the healthy human organism, as well as their therapeutic effect upon the organism when diseased.

In the early part of his career, in 1846, he began the study of the spinal cord as the transmitting agent of sensory impressions and motor impulses. He attacked a problem which seemed at that time already solved by the discovery of two kinds of nerve roots taking origin in the spinal cord—the motor roots and the sensory roots. Charles Bell had also extended that distinction to the columns of the cord itself.

The sensory transmission was thought to take place exclusively by the posterior columns, motor transmission by the anterior columns.

This was a very simple and clear doctrine, that appeared to be well established. But in the sciences, especially in those that relate to life, well-defined limitations of this kind are not often found. Brown-Séquard reopened the whole question by his experiments, especially by showing that the transmission of sensory impressions may take place through the gray matter of the cord quite as well as or better than by the posterior column.

At the same time he investigated another idea that had been casually referred to by the brothers Weber—that of inhibition; to this Brown-Séquard returned again and again during thirty years, giving to it immense développements.

The statements of Brown-Séquard were at first received with some distrust, as often happens with those who oppose generally accepted ideas and dominant schools. The official professors of the universities often have their course of instruction fixed and do not like to have the trouble of changing their teaching. Brown finally triumphed, for he pursued his experiments without relaxation, giving them increasing variety and attraction of form. He found that a transverse section of one-half of the cord caused a paralysis of movement on the same side and a paralysis of sensation on the opposite side in regions which receive their nerves from the part of the cord situated above the section. This is what Brown calls a unilateral paralysis. The experimental fact corresponded with various pathological observations made on man and was of use in diagnosing certain lesions of the spinal cord.

This was not all. The reflex power of the cord, almost abrogated at the moment it is separated from the brain, afterwards gradually increases and the section of the posterior columns is followed by hyperæsthesia. In a report read on the 21st of July, 1885, to the Society of Biology, Broca confirmed the exactitude of these experiments, causing a profound revolution in the doctrine of Bell. The discussion continued, none the less heated and active, from 1850 to 1860, without, however, causing Brown, whoever might contradict him, to have resort to those personalities which too often envenom scientific discussions.

A similar question of this sort, yet more complex, separated Brown-Séquard and Charcot in 1874. This was that of the central localization of functions. The paradoxical mind of Brown Séquard was always ready to raise objections to accepted theories. He gave three lectures to the Royal College of Physicians in London to show that there is no relation between a given cerebral lesion and a concomitant paralysis. The question is indeed a complex one, the simple relations which seem so evident a priori being often contradicted by certain secondary effects of a reflex nature, in which intervene some inhibitory symptoms. A local lesion of the cord or brain may thus cause congestions and hemor-

rhages in distant organs, or, indeed, œdemas and anæmias; it may even disturb or increase the nutrition of those organs; suspend or exaggerate their secretions. These effects may also be produced either on the opposite side from the injured or irritated nerve or on the same side. Conversely, the lesion or irritation of a principal nerve may produce, either at once or after a considerable time, disorders in the encephalic centers. For example, a section of the sciatic nerve increases the irritability of one-half of the nervous system and decreases that of the other half. In this kind of phenomena it may be that the same symptom may result from a lesion of different organs. And, inversely, the real efficient cause, the pathological *primum movens* can not be ascertained without a delicate and complete analysis of the phenomena. It may be remarked here that the excitability of the sensory or motor nerves that serve as intermediaries for such effects is independent of their special aptitude for the conduction of sensory impressions or motor impulses.

The assembling and interpretation of these phenomena constitute a special branch of physiology developed by Brown-Séguard, and comprised under the names *dynamogeny* and *inhibition*. It is an entirely new doctrine, which he opposed to that of cerebral localization. It concerns not only physiology but psychology itself; that is to say, the domain of conduct and intelligence which has its seat in the brain. These are indeed verities of fact independent of any metaphysical theory. Yet, we hasten to add, the conclusions of Brown-Séguard were too absolute. If the facts that he cited did not seem doubtful, he at least exaggerated them by a too wide generalization. He had, however, none the less, the merit of having stated this problem and shown its full extent.

There are few phenomena in which inhibition exerts a more striking influence than in those which result from the action of the vaso-motor nerves. As early as 1851 Claude Bernard had observed the local rises of temperature and increased activity of the circulation that follows a section of the cervical sympathetic nerve. Conversely, Brown discovered that a stimulation of that nerve contracts the same vessels that its section dilates and reduces the temperature of that region which shows a rise when the nerve is cut. By an analogous correlation, if we plunge one hand in water, a thermometer placed in the other hand shows a decrease in temperature.

The development of these ideas may be carried still further, and thus Brown was led to the most remarkable discoveries, for instance, to the experimental production of epilepsy and the hereditary transmissions of lesions by whose aid he was able to produce that malady. His experiments went back, indeed, to 1852-53. They were the immediate result of his investigations upon inhibition, and he carried them on for a quarter of a century. He operated preferably on guinea pigs, animals possessed of considerable vitality and easily propagated. He

was therefore always surrounded at his various residences by a collection of these little animals, and was always ready to show to visiting scientists experiments confirming his assertions.

The discoveries I have just sketched all relate to the study of the nervous system. If they do not form a single, methodical whole, they at least show an evident dependence and connection with each other. But Brown-Séquard also attacked other problems, some of which have contributed in no small degree to popularize his reputation. I will not speak here of his experiments upon asphyxia, upon red and dark blood, upon the exciting effect of carbonic acid, and the injurious effect of expired air, distinct from those of carbonic acid, etc. These observations were isolated, or nearly so. But we would leave an important gap in the biography of our friend if we did not give some space to his work and ideas concerning internal secretions.

Among the multiple glandular organs which are found in the human economy, the greater part produce liquids which can flow out through visible channels. The function of the glands is made evident by this means, and that of their secretions is also manifest, at least in a general way. Still, there are some whose use and even existence have remained obscure up to a recent period. Such are the spleen, the suprarenal capsules, the thyroid body, and others that might be mentioned. In 1856 Brown-Séquard took up the study of these functions. He began with the suprarenal capsules, incited to work in this direction by the existence of certain diseases of origin unexplained, except, indeed, that they coexisted with a lesion of the suprarenal capsules. Brown discovered that the extirpation of these glands in an animal was always followed by the death of the animal. This he attributed to the existence of some internal secretion of these organs, a secretion continually discharged into the blood and necessary for life. But he went no further at this time, and did not take the subject up again until twenty years later, in 1889.

This time he tried another gland and examined the physiological action of the testicular fluids, being led by divers reasons to suppose that those fluids contained certain substances which they also discharged into the blood and which tended to exalt the power of the nervous system and to keep up the vital energies. He did not hesitate to extract these fluids from the organs of animals and to make upon himself, by means of hypodermic injections, certain trials of them which appeared decisive. He concluded that he had discovered a new therapeutic method. The subject required delicate manipulation, not only because of the extraordinary precautions required for this kind of inoculations, but of charlatanism, always ready to possess itself of new curative procedures. Brown-Séquard did not cease to protest against the abuse by which his name was made to cover industrial enterprises. But he persisted in the idea and it developed with increasing importance, until it now constitutes an entire new method, designated under

the name of opotherapy, or treatment by organic extracts. Extracts from the pancreas, the liver, the suprarenal capsules, the spinal cord, the ovary, the prostate, the testicle, the thyroid gland, have thus been successively used in therapeutics with varying degrees of success.

The study of the thyroid extract especially has led scientists to the most unmistakable results.

This subject has not failed to extend itself still further. In fact, the preparation and effects of these various extracts have come to be confounded with serotherapy or the treatment by serums, modified for the purpose of combating diphtheria and various other diseases. The old inoculation of the virus of smallpox and the vaccination of Jenner have been brought under the same category of ideas. But it is beyond the limits of the present notice to try to state, even in a summary manner, the developments, every day more extensive, of the new doctrines and therapeutic methods. Under their influence the theory of germs is itself undergoing profound modifications, which tend to change the views which were at first held. Not only are the effects produced by microbes upon living organisms referred more and more to the domain of chemistry, and considered as independent of life, but the real agents that cause these phenomena are no longer supposed to be the microbes themselves. According to the new doctrine it is not the microbe that acts by virtue of its own life, carried on either with or without the assistance of air, in producing the phenomena of disease or of fermentation; but, as I formerly thought, if I may be permitted to cite myself, the real agents of all these phenomena are chemical agents, properly so-called, secreted by the microbes, yet distinct from them. These are immediate definite principles belonging to the class of the alkalis or the amides, that act either as toxines or antitoxines, according to circumstances.

In this way there tends to be formed an entirely new system of physiology and of practical treatment of disease, a system which recalls in some respects, and in certain of its methods, the primitive conceptions and even the superstitions of the early days of medicine. We certainly do not wish to fetter ourselves with the formulas of such a system any more than with those of the old ideas concerning the spiritual cause of disease and the vitality of miasms, or with those of the recent theories of the necessary and universal influence of microbes in pathology. Modern science does not become petrified in any dogmatism; but its incessant evolution is regulated by the very succession of discoveries accomplished according to its methods. Now, it is certain that the study of the internal function of glandular cells and that of the secretions of microbes has become to-day the point of departure for an entirely new set of therapeutic procedures; unknown ways have been opened by these discoveries for physiology and the medical sciences. To Brown-Séguard will be given the glory of having been one of the conquerors in this new domain.